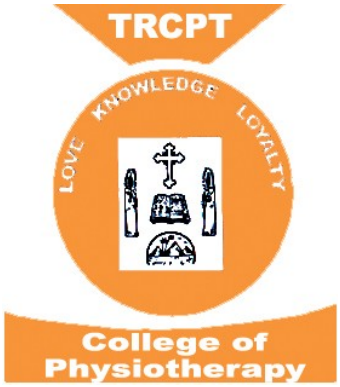
A STUDY TO COMPARE THE EFFECTIVENESS OF NERVE GLIDING EXERCISES AND SPLINTING VS ULTRASOUND AND SPLINTING IN IMPROVING FUNCTIONAL ACTIVITY FOR PATIENTS WITH ACUTE BILATERAL CARPAL TUNNEL SYNDROME.



DISSERTATION SUBMITTED TO
THE TAMILNADU DR M G R MEDICAL UNIVERSITY, CHENNAI.
TOWARDS PARTIAL FULFILLMENT AS A REQUIREMENT FOR
THE DEGREE
MASTER OF PHYSIOTHERAPY
APRIL 2011

Certificate

This is to certify that the research work entitled

A STUDY TO COMPARE THE EFFECTIVENESS OF NERVE GLIDING EXERCISES AND SPLINTING VS ULTRASOUND AND SPLINTING IN IMPROVING FUNCTIONAL ACTIVITY FOR PATIENTS WITH ACUTE BILATERAL CARPAL TUNNEL SYNDROME.

Was carried out by the candidate with the **(Reg.No.27092905)**Master of Physiotherapy student, at ***Thanthai Roever College of Physiotherapy***, submitted to The TamilNadu Dr. MGR Medical University, Chennai towards the partial fulfilment as a requirement for the degree Master of Physiotherapy (MPT-Neurology).

Place: Perambalur
Date:

Prof. Fredrick John, MPT.,
Principal
Thanthai Roever College of Physiotherapy
Perambalur 621212.

Certificate

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A STUDY TO COMPARE THE EFFECTIVENESS OF NERVE GLIDING EXERCISES AND SPLINTING VS ULTRASOUND AND SPLINTING IN IMPROVING FUNCTIONAL ACTIVITY FOR PATIENTS WITH ACUTE BILATERAL CARPAL TUNNEL SYNDROME.

Was carried out by the candidate with the ***(Reg.No.27092905) at Thanthai Roever College of Physiotherapy,*** under my the guidance, towards the partial fulfilment as a requirement for the degree Master of Physiotherapy submitted to the Tamil Nadu Dr. MGR Medical University, Chennai.

Place: Perambalur
Date:

Mr. K.Krishna Raja MPT,MIAP.
Associate Professor,
Guide
Thanthai Roever College of Physiotherapy
Perambalur 621212.

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Examiners:

1.

2.

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MARCH 2011

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On the successful completion of my study, I must make mention of those persons who spared their time and efforts in fulfullment of my task.

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CONTENTS

ABSTRACT

Aim of the study

To compare the effectiveness of Nerve gliding exercises and splinting Vs ultra sound and splinting in improving functional activity for patients with acute bilateral carpal tunnel syndrome.

Objective

- To find out the effect of Nerve gliding exercise and splinting in improving functional activity for patients with acute bilateral carpal tunnel syndrome.
- To find out the effect of ultrasound and splinting in improving balance for patients with acute bilateral carpal tunnel syndrome.
- To compare the difference of nerve gliding exercise and splinting and ultrasound and splinting in improving functional activity for patients with acute bilateral carpal tunnel syndrome.

Study design

Pre-test and post test experimental study design.

Study method

Purposive sampling technique was used. 20 samples were selected and equally divided into experimental group I and experimental group II.

Group I was treated with nerve gliding exercise and splinting and Group II was treated with ultrasound and splinting.

Measurement tool

Functional Status Scale.

Result

Statistical analysis done by using paired ‘t’ test showed that there is improvement in functional activity in group I and group II. Independent ‘t’ test using post test values between group I and group II showed improvement in group I that group II.

Conclusion

Results from the study showed nerve gliding and splinting is superior to ultrasound and splinting in improving functional activity for the patients with acute bilateral carpal tunnel syndrome.

1.INTRODUCTION

Carpal tunnel syndrome is most common and significant of all nerve entrapment syndromes (Phalen.G.S.1972). Carpal tunnel syndrome was first described by Sir James Paget in 1854, but the term was coined by Moerisch. It is the compression of the median nerve at the carpal tunnel and it causes 20% of all compression syndromes. It has been estimated prevalence of 125 cases/100,000 population. It is three times more common in women, and commonly occurs in fourth and fifth decades.

Anatomically, the carpal tunnel narrows in cross section at 2.0-2.5cm distal to the entrance, where it is rigidly bounded on three sides by bony structures and roofed by a thickened transverse carpal ligament (Robbins.H.,1980) which originates radially from the scaplhoid and trapezium, ulnarly from the pisiform and hook of hamate. The median nerve passes with nine extrinsic digital flexors, mainly with the tendons of flexor digitorum profundus and flexor digitorum superficialis in common sheath.

Any pathological condition that decreases the area of carpal tunnel (or) increase the volume of its contents may compress the median nerve. The disorders which decrease in space may be of developmental, traumatic, space occupying lesions, inflammatory, neuropathy, endocrine, occupational, miscellaneous and idiopathic. Rarely it may be due to thickening of transverse

carpal tunnel ligament (Michand, et.al.,1990) and in some cases, no cause for carpal tunnel syndrome can be found (Steward,1993).

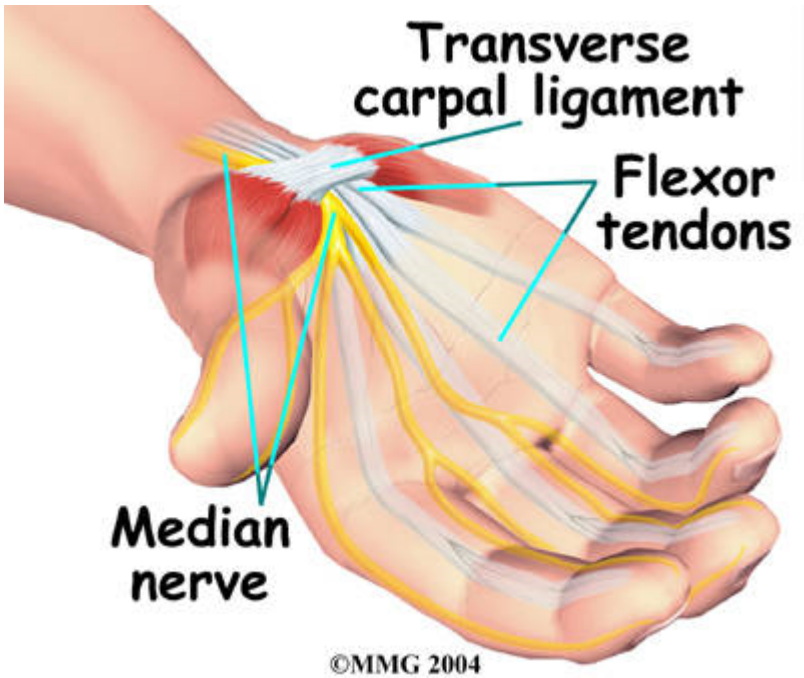
Over 90% of patient with carpal tunnel syndrome have either changes in feeling and strength of the affected hand (Carl Butterfield). The sensory symptoms are pain, tingling and numbness felt over the radial aspect of the hand may be the most common symptoms. Pain in the hand is severe at night (flick sign), and is fairly relieved by shaking or massaging it the hands or flicking or elevation the arm. Clumsiness and lack of dexterity is also frequent symptoms due to loss of sensation (or) weakness of thenar muscles.

Motor weakness will be seen in abductor pollicis brevis, flexor pollcis brevis and opponens pollicis brevis. Passive flexion or hyperextension of the affected hand at the wrist for more than 1 minute may worsen the symptoms. (Phalen.G.S.,1966). Percussion of the median nerve at the wrist causes paresthesia of the digits (Steward.J.D., 1978).

Conduction abnormalities often selectively involve the wrist to palm segment of the median nerve for both motor and sensory fibres (Kimura, 1971). Retrograde changes may also occur in the forearm as a result of severe compression at the wrist (Stohr.M., 1978).

The cure for carpal tunnel syndrome is to relieve pressure on the median nerve at the wrist level (Paul.R.). Surgery relieves the pressure over the nerve by sawing the roof and lengthens.(Jenett,1980).

Non-operative treatment is more effective in early stages such as NSAIDs and local corticosteroid injections. Volar wirst splint is required in acute stages. It appears that nerve gliding exercise may aid in the reduction of symptoms and improvement in functions in patients with CTS, (Jennifer M. Medina et al 2008).



1.1 Aim of the study:

The aim of this study was to investigate and compare the therapeutic effect of two different combinations in the treatment of acute bilateral carpal tunnel syndrome. The two different combinations are nerve gliding exercises and splinting verses ultrasound therapy and splinting in improving functional activity.

1.2 Need for the study:

The current conservative treatment includes splints, activity modification, non-steroidal anti inflammatory drugs, diuretics, pyridoxine and local injection of corticosteroids. Tendon and nerve gliding exercises have been used particularly for the management of postoperative CTS. Immobilization of the wrist in neutral position with a splint maximizes carpal tunnel volume and minimizes pressure on the median nerve. There are conflicting results on the efficacy of therapeutic ultrasound in the treatment of CTS.

This study has been conducted in an attempt to compare the effectiveness of nerve gliding exercises and splinting verses ultrasound therapy splinting to improve functional activity for acute bilateral carpal tunnel syndrome.

1.3 Operational Definition:

Carpal tunnel syndrome:

Pain or numbness that affects some part of the median nerve distribution of the hand [the palmar side of the thumb, the index finger, the radial half of the ring finger and the radial half of the palm] may radiate into the arm.

Splinting:

Splints are used to support the weak joints to assist actively with functional movement to immobilize to promote healing and to protect from injury and deformity. Fixing the dislocation or fracture could be done with a splint.

Nerve gliding exercises:

Nerve gliding exercise is a group of treatment technique to improve the actual excursion of the nerve. Nerve gliding exercises are commonly referred to as ‘neural flossing’, neural gliding or neurodynamic mobilization.

Ultrasound:

An inaudible sound with the frequency of 20,000 to 10,000,000,000 cycles per second. Ultra sound refers to mechanical vibrations which are essentially the same as sound waves but of a higher frequency. Such waves are beyond the range of human hearing and can therefore also be called ultrasonic. Ultrasonic energy or ultra sound describes any vibration at a frequency above

the sound range but it is frequencies of a few mega hertz that are typically used in physiotherapy: Several different frequencies are employed in the range from 0.5 to5MHz.

Functional status scale

This modified scale was developed assessing the functional status of the hand activity.

2. REVIEW OF LITERATURE:

2.1. Introduction:

Review of literature helps the researcher by providing sufficient reading material and literature available in the subject of research. It is not important that investigator is not under stress and strain in selection the topic for research. The research on acute bilateral carpal tunnel syndrome, nerve gliding exercises, splinting comparing with ultrasound, splinting and their effectiveness in treating carpal tunnel syndrome is reviewed in this chapter. Research over 30 years have established that conservative treatments are profoundly relieve symptoms and improve functional activity for acute bilateral CTS and more over work related causes are one to that syndrome.

1. ***David W. Levine et al 1993***

   A self administered questionnaire for the assessment of severity of symptoms and functional status in patients who have carpal tunnel syndrome, concluded that the scales for the measurement of severity of symptoms and functional status are reproducible, internally consistent and responsive to clinical change and that they measure dimensions of outcomes not captured by traditional measurements of impairment.

2. ***Kart l Resch et al 1997***

   Results suggest there are satisfying short to medium term effects due to ultrasound treatment in patients with mild to moderate carpal tunnel syndrome. Findings need to be confirmed and ultrasound treatment

will have to be compared with standard conservative and invasive treatment options.

3. ***Rozmaryn,L. M., Dovelle, S., Rothman E.R,et all 1998.***

   The researchers concluded that a significant number of patients who would otherwise receive surgical intervention for failure of traditional conservative treatment can be spared the surgical morbidity of a carpal tunnel release.

4. ***Akalin et al 2002.***

   A custom made neutral volar wrist splint was given to group 1 and group 2. The patients in group 2 were also instructed to perform series of nerve gliding exercises in addition to the splint treatment. At the end of treatment the improvement in group 2 was slightly greater. Patient satisfaction was investigated during the follow up period. A total of 72% of the patients in group 1 and 93% of the patients in group 2 reported good or excellent results.

5. ***J K Wilson and T.L SEVIER 2003***

   Trial suggests that ultrasound treatment has good short-term effectiveness and even yields satisfying medium term effects in patients with mild to moderate CTS.

6. ***Pinar L et al 2005 (updated)***

   The experimental group in which nerve gliding exercises were added to conservative therapy approaches demonstrated more rapid pain reduction, these patients also showed greater functional improvement especially in grip strength.

7. ***Brininger TL, Rogers JC, et al 2007***

Analysis of Variance showed a significant main effect for splint using SSS and FSS. Our results validated the use of wrist splints for the treatment of CTS and suggest that a splint that supports the wrist and MCP joints in neutral may be more effective.

8. ***Jennifer M. Medina et al 2008***

It appears that nerve gliding exercise may aid in the reduction of symptoms and improvement in functions in patients with CTS, while the efficacy of nerve gliding techniques for the treatment of CTS is not clear, trends toward pain and symptom reduction, improved sensation and improved function and strength.

9. ***Valma J 'robertson and Kerry G.Baker***

The therapeutic ultrasound is more effective in treating carpal tunnel syndrome than placebo ultrasound.

10. ***Daniel A Martinex, MA, DC***

Ultrasound has been widely used and accepted adjunct modality for the management of CTS.

11. ***N. Paciello et al.***

Using splint is a conservative therapy for the carpal tunnel syndrome splints action consists of reduction of bending – extension movements and taking the wrist in a position which minimize intracarpal compression.

12. Walker WC. Et al

Subjects receiving full time wear instructions showed superior improvement both motor and sensory when compared with subjects receiving night wear instructions.

13. Norvell JG

Carpal tunnel syndrome is a compressive neuropathy of the median nerve at the wrist.

14. Shawn Anthony

Carpal tunnel syndrome had the highest frequency of coverage with overuse injury of the hand.

15. Barnhart et al

The occurence of risk factors of CTS include the assembly workers of the industry which involve repeated or sustained flexion, extension or unlnar or radial deviation of the wrist.

16. Abbas et al

The risk factors include in electrical assembly workers whose jobs involved a precision (Pinch) grip and frequent repetition.

17. Wieslander et al.

They suggested that risk may double after > 1 year in a job involving repetitive wrist movement.

18. Andersen et al.

They reported sensory symptoms in the median nerve distribution and use of a right handed mouse and no risk was found with use of key boards.

19. Hagberg et al.

There were high risk of CTS in the work related problems that involve repetitive and forceful gripping.

20. Carneiro Rs

The mild and moderate CTS should be conservatively treated and severe carpal tunnel syndrome usually required surgery.

3. AIMS AND OBJECTIVES

i) Aim of the study:

To compare the effectiveness of nerve gliding exercise and splinting verses ultrasound therapy and splinting in improving functional activity for acute bilateral carpal tunnel syndrome.

ii) Objectives:

- To find out the effect of nerve gliding exercise and splinting in improving functional activity for acute bilateral carpal tunnel syndrome.
- To find out the effect of ultra sound therapy and splinting in improving functional activity for acute bilateral carpal tunnel syndrome.
- To compare the difference of nerve gliding exercise, splinting and ultrasound therapy, splinting in improving functional activity for acute bilateral carpal tunnel syndrome.

4. MATERIALS AND METHODOLOGY

4.1 Materials used

- Ultrasound
- Electrode gel
- Wrist volar splint

4.2 Statement of the study:

Work related, over load syndromes are chiefly associated with the upper limbs, where carpal tunnel syndrome [CTS] plays a leading role. It discusses on occupational leading to CTS. Here diagnostic methods [Subjective symptoms, physical examination, Manual provocative tests, Electro diagnostic], preventive and therapeutic [Nerve gliding exercise, splinting and ultrasound therapy], tools accessible functional status scale are used to treat acute bilateral carpal tunnel syndrome.

4.3 Title of the study:

A comparative study of the effectiveness of nerve gliding exercise in combination with splinting versus ultrasound treatment with splinting to improve functional activity in work related acute bilateral carpal tunnel syndrome.

4.4 Sources of Data:

The sources of data collected was primary in nature and it was collected from the respondents with the help of an functional status scale [FSS].

4.5 Study design:

Pre test and post test experimental study design.

4.6 Sample size:

20 patients who fit in to the inclusion criteria were taken. 10 patients were allotted for each group.

4.7 Sampling technique:

Purposive sampling technique.

4.8 Study setting:

- Ordnance Factory, Tiruchirappalli.
- Mary Madha physiotherapy clinic, Tiruchirappalli-21.
- Thanthai Roever college of Physiotherapy OP department, Perambalur.
- Rethna Global hospital, Tiruchirappalli.

4.9 Criteria for selection:

a) ***Inclusion Criteria:***

- ❖ Age: 45 – 60years.
- ❖ Sex: Commonly females and few males.
- ❖ Patients who diagnosed as acute stage of bilateral CTS by subjective, Physical examination and electro diagnostic test
- ❖ Patients who have work related causes.

b***) Exclusion Criteria***:

- ❖ Patients were excluded if they had secondary entrapment neuropathies.
- ❖ Chronic CTS who were referred for surgery.
- ❖ History of steroid injection into the carpal tunnel.
- ❖ Thyroid disease
- ❖ Diabetes
- ❖ Systemic peripheral neuropathy.
- ❖ Pregnancy
- ❖ Splint use
- ❖ Old age

4.10 Duration of Study:

1 Month

4.11 Hypothesis:

a***) Null hypothesis:***

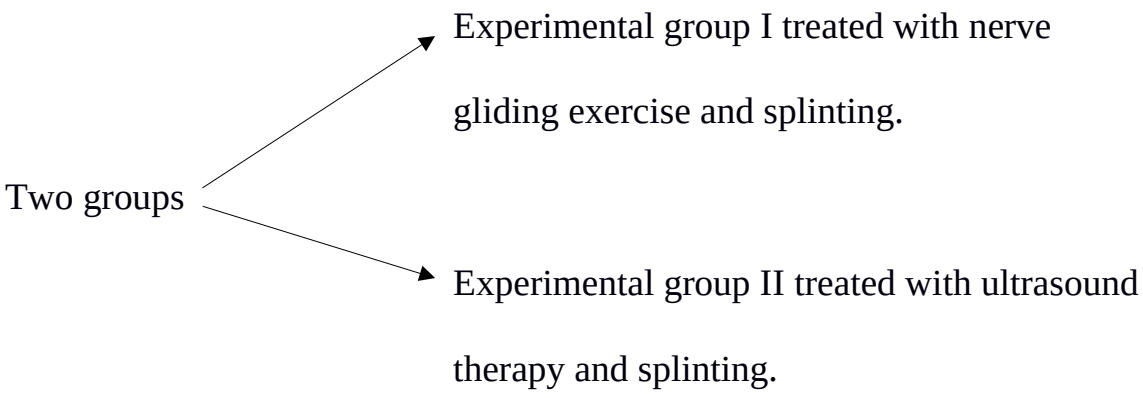
- ➢ There is no significant effect of nerve gliding exercise and splinting in improving functional activity for patients with acute bilateral CTS.
- ➢ There is no significant effect of ultrasound therapy and splinting in improving functional activity for patients with acute bilateral CTS.

- There is no significant difference in the effectiveness of nerve gliding exercise and splinting verses ultrasound and splinting in improving functional activity for patients with acute bilateral CTS.

b) ***Alternate hypothesis:***

- There is significant effect of nerve gliding exercise and splinting in improving functional activity for patients with acute bilateral CTS
- There is significant effect of ultrasound therapy and splinting in improving functional activity for patients with acute bilateral CTS.
- There is significant difference in the effectiveness of nerve gliding exercise and splinting verses ultrasound treatment and splinting in improving functional activity for patients with acute bilateral CTS.

4.12 Study Method:



4.13 Measurement Tool:

i) Functional status scale [FSS]

For assessing the functional activity of the patient prior and after the treatment, we should follow the functional status scale.

According to the scale, there are eight questions which we have to ask the patient, depending upon the scores we can know the degree of disability.

The first question is the way of writing.

The second question is the buttoning of clothes.

The third is holding a book while reading.

The fourth question is the gripping of a telephone handle.

The fifth is the opening of jars.

The sixth is the household chores.

The seventh is the carrying of grocery bags.

The eighth is the bathing and dressing.

These eight activities are the most essential activity which we come across in day to day life.

The chart given below is given to each patient before and after the treatment.

The patients are asked to circle the scores depending upon their ability.

The scores are calculated by using the formula

$$\frac{\text{Sum of responses}}{\text{Number of items}}$$

ie If the sum of response is 16

The score will be $\frac{16}{8}=2$

4.14 Techniques of Study:

Experimental group1:

To find out the effect of nerve gliding exercise and splinting in improving functional activity for acute bilateral carpal tunnel syndrome.

Nerve gliding exercises:

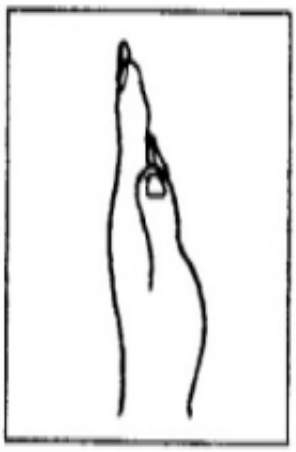
In this group the patients were instructed to perform nerve gliding exercises developed by Totten and Hinter. Brochures describing exercises were also given to patients

- During the median nerve gliding exercises the median nerve was mobilized by putting the hand and wrist in six different positions.
- During these exercises the neck and shoulder were in a neutral position and the elbow was in supination and 90degrees of flexion.
- Each position was maintained for 5 seconds.
- The exercise is applied as five sessions daily.
- Each exercise was repeated 10 times at each session.
- Exercise treatment was continued for five days in a week for 4 weeks.
- Physical examination and functional status were performed before and 4 week after the end of the treatment.

Starting Position 1

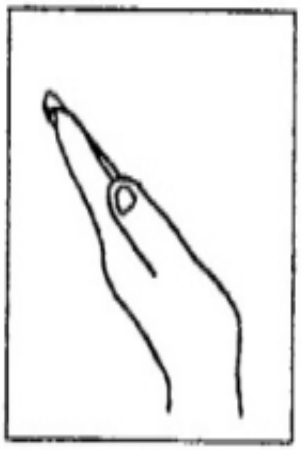
Wrist in neutral, fingers and thumb in flexion

Position 2



Wrist in neutral, fingers and thumb extended

Position 3

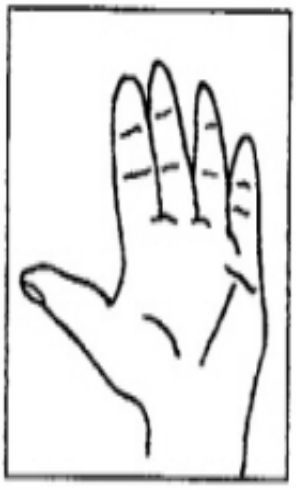


Thumb in neutral, wrist and fingers extended

Position 4

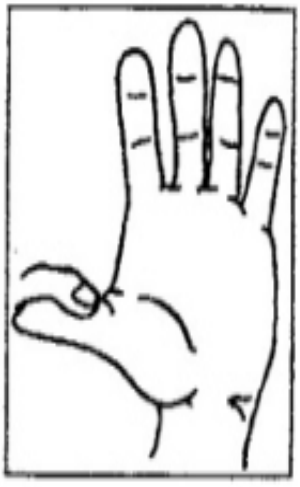
Wrist, fingers and thumb extended

Position 5



Same as in position 4, with forearm in supination (palm up)

Position 6



Same as position 5, other hand **gently** stretching thumb

Splinting:

- A custom made neutral volar splint was given to patients
- Patients were instructed to wear the splints all night and during the day for 4 weeks.

Experimental group II :

To find out the effect of ultrasound treatment and splinting in improving functional activity for acute bilateral carpal tunnel syndrome.

Ultrasound treatment and Para meters:

a. Parameters:

Frequency of 1 MHz and intensity of 1.0W/cm^2, pulsed mode 1:4 with a transducer of 5 cm^2 and with aqua sonic gel as the couplant.

b. Treatment area:

Ultra sound treatment was administered to the palmar carpal tunnel area.

c. Procedure:

- The apparatus was standardized initially, and the output was controlled regularly by a simple under water radiation balance.
- The apparatus head was applied with a gel.
- The pressure over the palmar area was mild to moderate.

d. *Treatment time:*

10 minutes per session.

e. Duration of treatment:

Total of 10 minutes ultrasound treatment was given once in a day five times in a week for 4 weeks.

Splinting II:

A custom made neutral volar splint was given to patients. Patients were instructed to wear the splints all night and also during the day for complete 4 weeks.

5. STATISTICAL ANALYSIS

i) Changes within group I and II are analysed using paired ‘t’ test

Paired $t = \frac{\acute{d}\sqrt{n}}{s}$

$$s=\sqrt{\frac{\sum d^2-\left(\acute{d}^2\right)n}{n-1}}$$

$\acute{d}$ =mean of deviation

n = total number of subjects

s = standard deviation

$\sum d^2$ = sum of squared deviation

ii) Difference in outcome between group I and group II are analysed using independent 't' test

independent $t=\frac{\acute{X}-\acute{X}_2}{s}$ $\frac{\sqrt{n_1+n_2}}{n_1}$

$$s=\sqrt{\frac{\sum\left(X_1-\acute{X}_1\right)\square^2+\sum\left(X_2-\acute{X}_2\right)\square^2}{n_1+n_2-2}}$$

$\acute{x}_1$ = mean of group I

$\acute{x}_2$ = mean of group II

n_1 = number of samples in group I

n_2 = number of samples in group II

S = standard deviation

Level of significance 5%

6. DATA ANALYSIS

6.1 Tabulation

Paired ‘t’ test

A. Experimental group I [nerve gliding exercise and splinting]

	Pre test	Post test
Mean	4.4	1.22
‘t’Value	14.48	

Level of significance: $p<0.05$ and significant

Experimental group II [ultrasound and splinting]

	Pre test	Post test
Mean	4.1	2.5
‘t’Value	33.47	

Level of significance: $p<0.05$ and significant

Unpaired test

A. Post test between experimental group I and group II

	Group I	Group II
Mean	1.22	2.5
‘t’Value	9.1717	

Level of significance: $p<0.05$ and significant

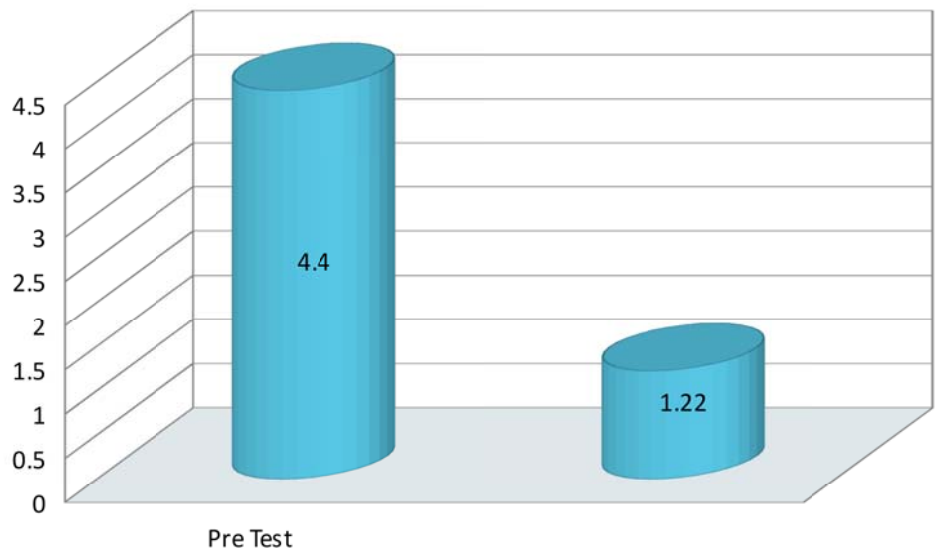
6.2 Graphical representation

Funcitional status scale

Paired ‘t’ test

A. Experimental group I (Nerve gliding and splinting)

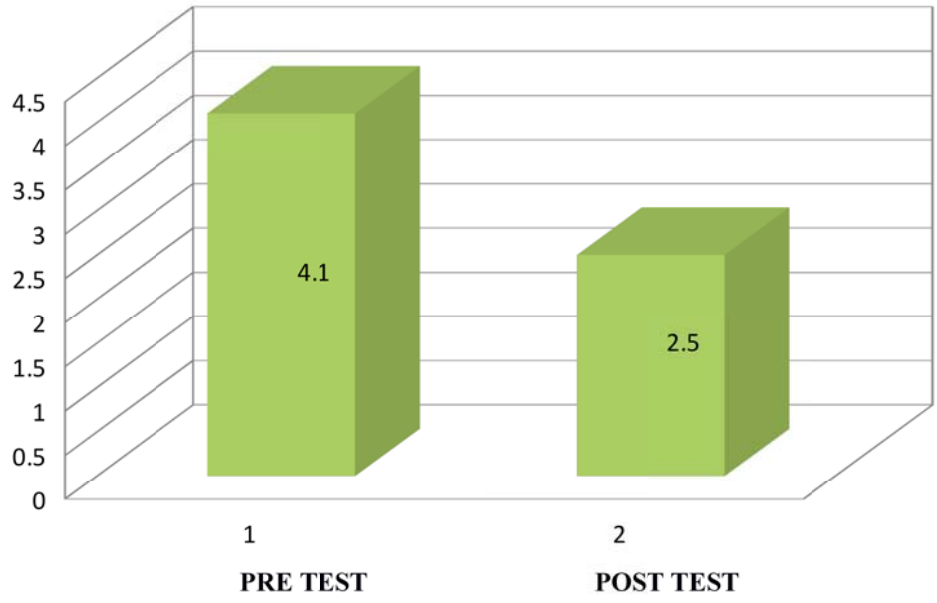
FSS



PRE TEST **POST TEST**

B. Experimental group II (Ultra sound and splinting)

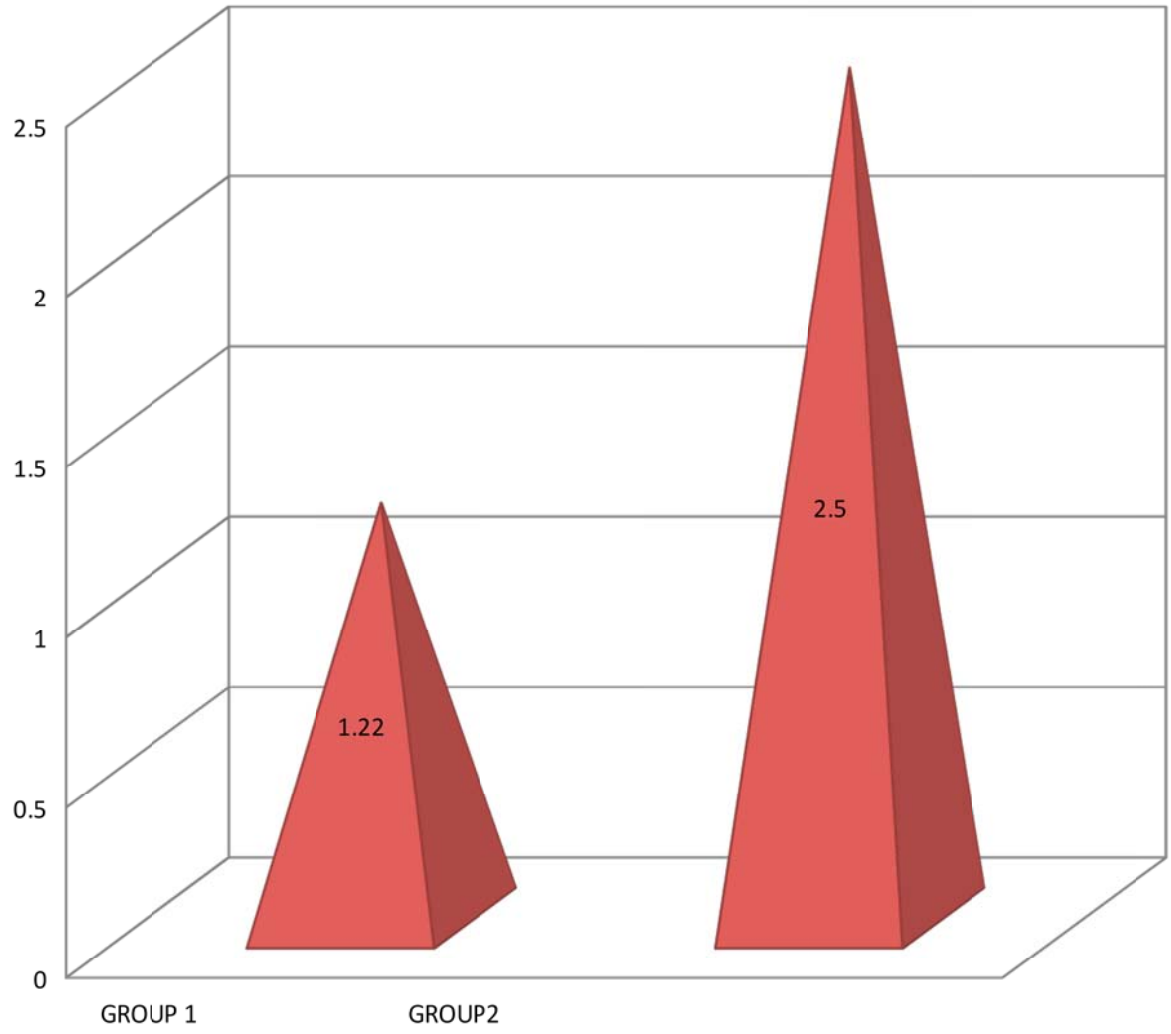
FSS



Independent 't' test

Post test of experimental group I and group II

FSS



GROUP I GROUP II

7. RESULT

Paired 't' test

Functional status scale

Experimental group I (Nerve gliding and splinting)

For 9 degree of freedom at 5 % level of significance the calculated‘t’ value is 14.48 which is greater than the table ‘t’ value 2.262. Hence alternate hypothesis is accepted.

Experimental group II (ultrasound and splinting)

For 9 degree of freedom at 5% level of significance the calculated‘t’ value is 33.47 which is greater than the table ‘t’ value 2.262. It shows there is significant difference between the data. Hence alternate hypothesis is accepted.

Unpaired‘t’ test

Functional status scale

Post test value (Experimental group I&II)

When the post test value of experimental group I and experimental group I were analysed by unpaired ‘t’ test, the calculated ‘t’ value is 9.1717. The table‘t’ valve at 5% level of 18 degree of freedom is 2.101 which is less than the calculated ‘t’ value. So there is significant difference between two group and hence alternate hypothesis is accepted.

8.DISCUSSION

Carpal tunnel syndrome [CTS] is a collection of characteristic symptoms and signs that occurs following entrapment of the median nerve within the

carpal tunnel. Usual symptoms include numbness (or) tingling paraesthesias and pain in the median nerve distribution. Symptoms are worst at night and often wake the patient.

The study was conducted to compare the effectiveness of nerve gliding exercises, splinting and ultrasound therapy, splinting to improve functional activity in acute bilateral carpal tunnel syndrome.

The study comprised of two experimental groups of 10 samples each. They were included according to the inclusive and exclusive criteria. The samples were selected using purposive sampling design. The samples were divided into two experimental groups where experiment group I received nerve gliding exercises and splinting whereas experiment group II received ultrasound therapy and splinting. Pre and post test scores were noted according to the study design. Functional activities were assessed using functional status scale.

The statistical analysis was done using paired‘t’ test and independent‘t’ test. The results obtained after analysis showed there is significant improvement in group I treated with nerve gliding exercise and splinting compared to group II

treated with ultrasound and splinting and found that there is significant difference between two groups.

The improvement is due to nerve gliding exercises and splinting.

Reasons:-

- It is important in the achievement of reducing usual symptoms such as numbness or tingling, paraesthesial and pain.
- It is particularly in the development of funcitional activity [Basic activites like writing, buttoning of clothes, holding a book, gripping, opening of jars, carrying of grocery bags, bathing and dressing]
- Nerve gliding exercise is beneficial in regulation of functional activity.
- Splinting helps in bringing out positive outcome in preventing the incursion of the lumbrical muscles into the distal carpal tunnel, which occurs with wrist flexion during sleep.
- Both nerve gliding exercise and splinting improve the actual excusion of the nerve by allowing the nerve to move freely to improve functional activity and to prevent incursion of the lumbrical muscles into the distal carpal tunnel.

9. SUMMARY AND CONCLUSION

In summary, compression of the median nerve within the carpal tunnel at the wrist is responsible for the symptoms, signs and electro diagnostic findings in CTS.

A functional impairment is a disturbance that causes an individual to feel discomfort and to deviate from normal work activities. Hand function is an important part in our locomotor system.

The hand function plays an important role to do normal functional activities, Pre hension activities of the hand involve the grasping or taking hold of an object between any two surfaces in the hand. Pre hension can be categorized as either power grip or precision handling.

Power grip- cylindrical grip, spherical grip, hook grip.

Lateral pre hension is a rather unique form of grasp.

Precision handling- pad to pad pre hension, tip to tip pre hension, pad to side pre hension.

The function position is

1. Wrist complex is in slight extension (20^0) and slight ulnar deviation (10^0)

2. Fingers moderately flexed at the mcp joint (45^0) slightly flexed at the PIP joint (30^0) and slightly flexed at the Dip joint.

   Dysfunction in the hand function leads to decrease in muscle tone and functional impairment in daily living activities; Exercise helps to activate those damage muscles have been effective in reducing carpal tunnel syndrome.

Physical therapy interventions like nerve gliding exercises, splinting and ultra sound therapy, splinting were given to selected 10 Patient in each group.

Pre test, post test scores are noted and analysis was done using paired‘t’ test for both the group and the statistical analysis shows that there is significant improvement in functional activity with both the techniques. But on doing independent‘t’ test between the post test score of both the group, the statistical analysis shows that the nerve gliding exercise and splinting is found to be more effective than ultrasound and splinting Akalin et al 2002

10. LIMITATIONS AND SUGGESSTIONS

- This study has been carried out on small sample size. Studies can be done with larger samples.
- This study was done in a short term and long term study should be performed to validate the finding.
- Further studies on comparing nerve gliding exercise, splinting verses ultrasound and splinting in improving functional activity can be done.

- Further studies on comparing more combination of 3 treatments like nerve gliding exercise, ultrasound and splinting can be used to improve functional activity in acute bilateral Carpal tunnel syndrome.
- Studies on ultrasound treatment, splinting nerve gliding exercise, laser treatment given in combination has been proved to be effective can also be done.
- Assessment of improvement in median nerve can also be done by electro neuro physiological test, imaging technique.
- Studies in additional measures like preventive measures and post exercise or warm up programme in improving functional activity for acute bilateral CTS can also be done.

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APPENDIX-I

NEUROLOGICAL EVALUATION CHART FOR CARPAL TUNNEL SYNCROME

DEMOGRAPHIC DATA:

1. Name
2. Age
3. Sex
4. Occupation and description of work
5. Address
6. Date of assessment
7. Chief complaints

HISTORY

1. History of illness
2. Past medical history
3. Present medical history
4. Social and family history
5. Associated medical problems

VITAL SIGNS

1. Temperature
2. Blood pressure
3. Pulse rate
4. Respiratory rate

ON OBSERVATION

1. Deformity
2. Built
3. External appearance
4. Tropic changes

ON EXAMINATION

MOTOR EXAMINATION

1. **Range of motion:[joint]**

Wrist	flexion
	Extension
	Ulnar deviation
	Radial Deviation
	Pronation
	Supination
Thumb	IP joint flexion
	IP joint extension
	MCP joint flexion
	MCP joint extenson, Passive
	Carpo-metacarpal abduction
	Carpo-metaearpal flexion
Fingers	MCP joints, flexion
	MCP joints, Passive hyperextension
	Proximal IP joints flexion
	Distal IP joints flexion

2. **Muscle tone:**

Decreased/flacid

Increased/ Spasticity, rigidity.

3. **Muscle Power**
4. **Muscle wasting**

SENSORY EXAMINATION

Superficial

Light touch

Pin prick

Temperature

Pressure

Deep sensation

Two point discrimination

Vibration Sense

Functional activities

Writing

Buttoning of clothes

Holding a book

Gripping

Opening of Jars

Carrying of Grocery of bags

Bathing

Dressing

APPENDIX-II

Functional status scale

For assessing the functional activity of the patient prior and after the treatment, we should follow the functional status scale.

According to the scale, there are eight questions which we have to ask the patient, depending upon the scores we can know the degree of disability.

The first question is the way of writing.

The second question is the buttoning of clothes.

The third is holding a book while reading.

The fourth question is the gripping of a telephone handle.

The fifth is the opening of jars.

The sixth is the household chores.

The seventh is the carrying of grocery bags.

The eighth is the bathing and dressing.

These eight activities are the most essential activity which we come across in day to day life.

The chart given below is given to each patient before and after the treatment.

The patients are asked to circle the scores depending upon their ability.

The scores are calculated by using the formula

$$\frac{\text{Sum of responses}}{\text{Number of items}}$$

ie If the sum of response is 16

The score will be $\frac{16}{8}=2$

Functional status scale

Activity	No Difficulty	Mild Difficulty	Moderate Difficulty	Severe Difficulty	Cannot do all due to hand or wrist symptoms
Writing	1	2	3	4	5
Buttoning of clothes	1	2	3	4	5
Holding a book while	1	2	3	4	5

reading					
Gripping of a telephone handle	1	2	3	4	5
Opening of jars	1	2	3	4	5
Household chores	1	2	3	4	5
Carrying of grocery bags	1	2	3	4	5
Bathing and dressing	1	2	3	4	5

According to this scale, as the score increases, there will be more severe difficult in doing these activities.

If the score decreases, there will be less difficult in doing these activities.

The experimental group I the post test value is less when compared to the post test value of the experimental group II.

APPENDIX-III

DATA PRESENTATION

- 10 Patients were treated with Nerve gliding exercise and splinting.

S.No	PRE TEST	POST TEST
1.	4	1
2.	4.1	1.2
3.	4.2	1.3
4.	4.3	1.1
5.	4.4	1.2
6.	4.5	1.1
7.	4.6	1.2
8.	4.7	1.1

9.	4.4	1.4
10.	4.8	1.5

C. Experimental group II

- 10 patients were treated with Ultrasound and splinting.

S.No	PRE TEST	POST TEST
1.	4.4	2.88
2.	4.25	2.75
3.	4.5	3.25
4.	4.25	2.75
5.	4.5	2.62
6.	4.6	2.75
7.	4.8	2.25
8.	4.12	2.38
9.	4	2.62
10.	3.88	2.5

APPENDIX-IV

CONSENT FORM

INVESTIGATOR: Prof.K. Krishnaraja MPT (Neurology)

I ..... voluntarily consent to participate in the research study

The researcher has explained to me the treatment approach in brief, the risk of participation, and answered the questions related to the research to satisfaction. I understand that I may draw from the study at any time and without any prejudice.

Participant's Signature:

Signature of Witness: